

The Effects of Group Size on Outcomes in High-Risk, Maternal-Newborn Simulations

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Abstract

The purpose of this study was to determine how evaluations of two perinatal simulations varied by group size among junior BSN students enrolled in a developing families course. Students were assigned to participate in simulation groups of 9-10(N=24) or groups of 5 (N=24). Data were collected on the Simulation Design Scale and Student Satisfaction and Self-Confidence in Learning instruments. While several scales were rated higher by the smaller group, mean scores for all study variables were greater than 4 on 5-point scales indicating both simulations were well received by all participants. This study concluded that the choice of simulation group size should be determined according to student experience, learning objectives, and instructor resources. As video streaming allows live feeds to sites beyond the sim lab, more research is needed on learning outcomes when simulation is used in even larger groups or lecture courses.

Key Words: High-risk newborn; Maternal-newborn nursing; Maternal-newborn simulation; NLN -Jeffries simulation framework; Nursing education; Post-partum hemorrhage; Simulation.

Introduction

A nursing simulation is defined as an event or situation made to closely resemble clinical practice (Jeffries, 2005). Simulation has been heralded as a safe and effective educational strategy that bridges gaps between theoretical concepts and practice (Childs & Sepples, 2006; Hovancsek, 2007). In recent years there has been a proliferation of literature surrounding simulation, yet many questions remain unanswered regarding best simulation practices (McNelis, Jeffries, Hensel, & Anderson, 2009). One such question is how many students can be involved in a given simulation while still maintaining good learning outcomes. Using the National League for Nursing(NLN) Jeffries simulation framework (Jeffries, 2005), the purpose of this study was to explore how group size affected students' perceptions of design adequacy, satisfaction, and self-confidence from participation in two high-risk, maternal-newborn simulations.

Background

The literature reports a wide range of simulation implementation practices. Some instructors use simulation to teach or evaluate a single student at a time (Bremner, Aduddell, Bennett, & VanGeest, 2006; Henneman et al., 2010; Radhakrishnan, Roche, & Cunningham, 2007), but much of the literature reports the use of simulation in groups. When used as a group teaching and learning strategy, simulation incorporates what Chickering and Gamson (1987) defined as best educational practices, including collaborative learning (Jeffries, 2005). Proficiency in teamwork and collaboration is now seen as one of the quality and safety education for nurses (QSEN) competencies for practice (Cronenwett et al., 2007). Simulation may serve as a method to develop such collaboration skills (Jeffries & McNelis, 2008). Still,

there is a gap in the literature on how many students can participate in a simulation while maintaining high expectations and good learning outcomes.

Implementing simulations with groups of four students has been frequently reported in the literature (Bambini, Washburn, & Perkins, 2009; Butler, Veltre, & Brady, 2009; Doran, & Mulhall, 2007; Hodge, Martin, Tavernier, Perea-Ryan, & Alcala-Van Houten, 2008; Jeffries, & Rizzolo, 2006; Smith & Roehrs, 2009). In four-student groups, one student is assigned the role of the primary nurse. The other students are assigned roles such as secondary nurse, family member, observer, or recorder. In a multi-site trial, Jeffries and Rizzolo (2006) found that when students were assigned to the role of an observer in simulation groups of four students, they learned as much as the students assigned to more active roles. Those researchers suggested that the findings indicated an additional student could easily participate in a simulation as an observer without compromising learning.

Childs and Sepples (2006), on the other hand, felt expanding simulation groups to five students was problematic. Utilizing groups of four to five students in a mock code simulation, Childs and Sepples believed that on the two occasions when groups of five students were used, one student felt less involved. Those researchers expressed concern that larger groups allowed weaker students to take a more passive role. However, it is possible that what is viewed as passive learning may indicate a preference for solitary learning. Fountain and Alfred (2009) found that small simulation groups facilitated learning for students who preferred both social and solitary learning. Those researchers felt that students who preferred social learning had the opportunity to discuss issues, while students with a preference for solitary learning had the opportunity to observe others. However, Fountain and Alfred did not report the exact number of students that constituted their small groups.

Other studies have shown positive outcomes with simulation groups of five students. In a comparison of outcomes from a high versus low- fidelity acute coronary syndrome simulation, researcher found high levels of satisfaction with roles of two nurses, a pharmacist, recorder, and observer (Kardong-Edgren, Lungstrom, & Bendel, 2009). In another study, Kardong-Edgren, Starkweather, and Ward (2008) utilized five-student groups for three simulations in a first clinical course. The researchers reported that the students perceived the simulations favorably, and it was noted that all students passed the end of the course written exam for the first time in the faculty's memory. However, the researchers felt attributing this finding to simulation alone was premature.

Simulation groups of six students have also been reported. Cantrell, Colleen, and Cash (2008) designed three pediatric simulations for use in a senior level parent-child nursing course: a young child with asthma; an adolescent with sickle cell anemia, and a well-child scenario. Students were assigned to participate in groups of six with two direct care providers and four observers. Roles were alternated so that all participants could provide direct care in at least one scenario. The researchers reported that the students experienced satisfaction and self-confidence with the simulations and felt that the simulations were well-designed.

One management simulation reported the use of six-student groups utilizing the roles of charge nurse, registered nurse, licensed practical nurse, unlicensed staff member, and two student observers (Reed, Lancaster, & Musser, 2009). However, one recommendation for revision of that simulation included increasing the participants from 6 students to 16 so that students could be patients in the beds. It was then suggested that patients change to caregiver roles in another scenario.

State nursing regulations have nursing instructors supervising 8-12 students and even as many as 18 students, depending on the clinical setting (Nehring, 2008). For those instructors, implementing simulations with groups of 5-6 students poses the problem of what to do with the remaining students. Some authors have reported using entire clinical groups. For instance, Schoening, Sittner, and Todd (2006) reported rotating entire clinical groups of 7-8 students through a two-part, high-fidelity, preterm labor simulation. Students were assigned to the nurse group or observer group. The nurse group worked as a team to provide care; the observers watched in real time as the video was projected into a separate room. The observers developed care plans for the patients and evaluated their peers. In the second phase the following week, the students switched roles. Upon analysis of the students' journals, Schoening et al. found that students valued the experience with one of the most prevalent themes being that of gained confidence and self-efficacy.

Using larger clinical groups of 10 students, Robertson (2006) reported the outcomes of a three-part, unfolding preeclampsia simulation. Each group was subdivided into teams of three to four students. Each team acted as coordinators of care for one part of the simulation while the other two groups observed. While some students reported lack of familiarity with simulation as a problem, overall the students rated the activity as positive and felt it increased their knowledge and clinical preparedness.

The use of even larger groups has been reported. Cato, Lasater, and Peebles (2009) used groups of 12 students for an acute care simulation where 3 students provided care and the remaining 9 students observed via live video stream in the debriefing room. These authors supplemented the simulation and debriefing with a post-simulation reflective activity using a clinical judgment rubric. Review of the student self-assessments showed that the majority of

students were able to think deeply about the simulated patient encounters and their reflective thinking continued days and weeks beyond the learning event.

Perhaps one of the largest simulation groups reported involved the use of 43 senior BSN students in a multidisciplinary, day-long, pandemic influenza drill (Stoelting-Gettelfinger, Krothe, & Hensel, 2009). In addition to the students, approximately 500 emergency preparedness volunteers participated in the drill. However, students felt this simulation was exhausting and lacked key simulation design features. Thus, review of the literature offers no clear answer on how many participants an instructor should include in any given scenario to maximize students' simulation experiences while maintaining good learning outcomes.

Method

This quasi-experimental, IRB- approved study was done in conjunction with the Fairbanks Simulation Scholars Institute, a faculty development program involving four Schools of Nursing. The convenience sample consisted of 54 BSN students enrolled in a developing families clinical course over two semesters. The first semester, 29 students were assigned to participate with their entire clinical group on a simulation day that included five high-risk, maternal- newborn scenarios resulting in two groups of 10 and one group of 9 students. The second semester, 29 students were assigned to participate with half of their clinical group in three scenarios resulting in five groups of 5 students and one group of 4 students. Half of the clinical group attended a morning simulation session, and the other half attended the afternoon session. Data was not collected on the four-student group, as one student had previously participated in the simulations. All simulations were designed using a standard template (Jeffries, 2007). Each simulation ran 20 minutes with a minimum of 20 minutes of debriefing time. All students were assigned a direct care provider role at least once during the day.

The final scenarios of the day included a postpartum hemorrhage simulation designed using a Vitalsim® manikin and a high-risk newborn simulation using a CPR style manikin. The maternal scenario took place in the recovery period and involved initiating a postpartum hemorrhage protocol. Roles assigned were two nurses, a grandparent, and observers. The newborn simulation involved finding bilious aspirate and a bloody stool on a newborn ordered to receive a gavage feeding for hypoglycemia. Roles assigned were nurse, LPN, mother, and observers. All scenarios took place in a large room, not specifically designed for simulation, in the nursing learning resource center (NLRC). The course lead instructor, who was the clinical instructor for two sections, played the role of the nurse giving report, the physician on the phone, and guided the debriefings. The instructor for the additional four clinical sections participated in the debriefing of those groups.

Data were collected on the last two scenarios using the NLN Simulation Design Scale and the Student Satisfaction and Self-Confidence in Learning instrument. Demographic data and a self-evaluation were also collected. The Simulation Design Scale is a 20-item, 5-point scale developed during the Laederal study to assess student perceptions regarding the features of instructor-developed simulations (NLN, 2007). Students are asked to rate a simulation for both the presence and importance of five key design features. Items are scored from strongly disagree (1) to strongly agree (5). Content validity was established by expert review. The tool was reported to have good internal consistency with Cronbach's alpha scores for the presence of feature scale of 0.92 and importance of features scale of 0.96. The Student Satisfaction and Self-Confidence in Learning instrument is a 13-item instrument designed to measure student satisfaction (five items) with the simulation activity and self-confidence in learning (eight items) using a 5-point scale. Reliability was tested using Cronbach's alpha: satisfaction = 0.94; self-

confidence = 0.87. Reporting of the results from both NLN tools has varied from averaged scales (Cantrell et al., 2008; Smith & Roehrs, 2009) to summative scales (Butler et al, 2008; Fountain & Alfred, 2009; Hoadly, 2009; Kardong-Edgren et al., 2008).

Results

Data were analyzed using independent *t*-tests on PASW version 17. Surveys were returned by 52 students. Four surveys were missing more than 10% of data and were excluded from the study. The final sample for data analysis contained 24 students per group for a total of 48 students. All participants were single females with a mean age of 21.1 years (*SD*=.62). The majority of participants reported being Caucasian (96%).

Mean scores for all study variables were greater than 4 on 5-point scales indicating both simulations were well received by all participants. Table 1 shows that the smaller groups rated three design elements higher than the larger groups for the postpartum hemorrhage scenario.

Table 1. Postpartum Hemorrhage Simulation Design Scale (N=48)

Feature	Group Size	Design Scale				Importance Scale			
		<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Objectives	5	4.5	.35	3.209	.002**	4.6	.44	1.322	.19
	10	4.2	.40			4.5	.43		
Support	5	4.2	.68	1.440	.15	4.2	.80	-.065	.94
	10	3.9	.54			4.2	.66		
Problem Solving	5	4.3	.38	1.447	.14	4.4	.50	1.371	.17
	10	4.1	.42			4.2	.43		
Feedback	5	4.8	.18	3.092	.004**	4.6	.39	1.757	.08
	10	4.5	.46			4.4	.41		
Fidelity	5	4.7	.42	2.310	.026*	4.7	.51	1.977	.05
	10	4.3	.68			4.4	.59		

Note: * significant at $p < .05$ (two-tailed); ** significant at $p < .01$ (two-tailed)

Table 2 shows that the smaller groups rated every design scale item higher than the larger groups except for the element of support in the high-risk newborn scenario. Total mean satisfaction scores were 21 ± 2 in the groups of 10 and 23 ± 2 in the groups of 5 students for both scenarios. Based on the mean scores and standard deviation for the postpartum hemorrhage simulation, satisfaction scores for this study had a large effect size (Cohen's $d = .83$).

Table 2. High-Risk Newborn Simulation Design Scale (N 48)

Feature	Group Size	Design Scale				Importance Scale			
		<i>M</i>	<i>SD</i>	<i>t</i>	<i>P</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Objectives	5	4.4	.45	2.77	.008**	4.6	.35	2.17	.03*
	10	4.0	.48			4.4	.50		
Support	5	4.4	.53	1.59	.119	4.6	.42	2.20	.03*
	10	4.1	.59			4.3	.60		
Problem Solving	5	4.5	.40	2.99	.004**	4.5	.37	2.55	.014*
	10	4.1	.43			4.2	.48		
Feedback	5	4.7	.37	2.43	.019*	4.8	.32	3.37	.002**
	10	4.4	.48			4.4	.47		
Fidelity	5	4.6	.43	2.1	.039*	4.7	.51	2.52	.015*
	10	4.3	.63			4.4	.45		

Note: * significant at $p < .05$ (two-tailed); ** significant at $p < .01$ (two-tailed)

Other findings for the confidence and satisfaction are displayed in Table 3. While satisfaction was higher in smaller groups, group size was only associated with increased self-confidence for the newborn scenario.

Table 3. Satisfaction and Self-Confidence in Learning (N=48)

	Group Size	Postpartum Hemorrhage				High-Risk Newborn			
		<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
Satisfaction	5	4.65	.40	2.86	.006**	4.6	.41	2.68	.010**

	10	4.28	.49			4.2	.48		
Self-confidence	5	4.24	.34	.93	.346	4.3	.33	2.09	.042*
	10	4.13	.46			4.0	.47		
Note: * Significant at $p < .05$ (two-tailed); ** significant at $p < .01$ (two-tailed)									

Discussion

In the field of maternal-child nursing education, meeting course objectives is often difficult in the clinical setting alone (Jeffries, Bambini, Hensel, Moorman, & Washburn, 2009). When the authors of this study decided to implement simulation to improve course outcomes, the dilemma arose of having no specific obstetrical equipment, no designated simulation space, and no support staff. On clinical days, instructors were expected to supervise their 10 students and ensure that they met the minimal course clock hours. Time in the NLRC had to be arranged around the needs of sophomore students enrolled in foundational courses. Simulation was implemented with entire clinical groups simply because it was the most feasible format. Observation and student feedback suggested that the simulations helped students gain a better understanding of the perinatal spectrum and served as a vehicle to teach the QSEN competencies. Still questions remained if the 10-student format was consistent with best teaching and learning practices.

Tanner (2006) recommended new models of nursing education focus more on attaining learning objectives than completing predetermined clock hours. Therefore, a decision was made to pilot simulation in half clinical groups, half-day formats. The findings of this study were reassuring as all students viewed both simulations as effective teaching and learning methods even though lower fidelity equipment was utilized in an open room not specifically designed for simulation. While many findings were significantly higher for the smaller groups, it is important to recognize that the larger group still had good outcomes. Higher mean satisfaction scores were found among the 10-student groups in this study than the 6-student groups used by Cantrel et al.

(2008) in a pediatric simulation day consisting of three scenarios ($M= 3.82$, $SD=.41$).

Additionally, the 10-student group satisfaction scores were comparable to the findings of one simulation (21 ± 2) in a series of three that utilized groups of five students (Kardong-Edgrens et al., 2008).

An interesting study finding was that group size mattered more in the newborn scenario than the maternal scenario. The debriefing indicated that students felt the newborn scenario was more challenging because they had little exposure to infants, whereas the maternal scenario built on the familiar concept of adult shock. The newborn scenario included complex teamwork elements including appropriate delegation, taking an order from a physician, and dealing with a distressed parent. The findings suggest smaller groups might be most beneficial when students are applying newer concepts or when scenarios are very complex.

Limitations

The differences in outcomes in this study are most likely only partially explained by group size. This study utilized a convenience sample. Students in the 10-student groups were in the second semester of their junior year compared to the students in the smaller groups who were in the first semester of their junior year. It is difficult to assess how experience factored into the results. As the 10-student groups participated in simulation for the entire clinical day, it is also difficult to determine how much fatigue factored into their satisfaction. Completed surveys were returned by only 83% of the larger groups compared to 96% of the smaller groups, suggesting that students who had participated all day were ready to leave. Another study limitation was that no effort was made to delineate outcomes by role assumed. Still, closing discussions and written feedback indicated that the students valued the experience. One of the most frequent comments among all participants was that they wanted more simulation opportunities. The smaller student

groups reported enjoying more opportunities to actively participate. The larger groups liked the variety of doing five simulations, but some students did report being self-conscious with so many observers in the room.

The difference in scores for the newborn scenario suggests that there are factors better addressed in smaller simulation groups, but more research is needed to determine exactly what those factors are. The Carnegie report calls for a better integration of classroom and clinical education (Benner, Sutphen, Leonard, Day, & Shulman, 2009). This study showed good learning outcomes could be obtained with up to seven observers in the same room. Other researchers have reported good outcomes when simulations were projected to observers in other rooms (Cato et al., 2009; Schoening, et al., 2006). As video streaming allows live feeds to even larger groups, more studies are needed to determine if projecting simulations in the classroom can produce favorable learning outcomes similar to those obtained when simulation is used in clinical education.

Conclusion

Inefficient use of student and faculty time is one of the problems with the current clinical education model (Tanner, 2006). Still, state regulations may limit instructors' options in regards to the use of simulation as clinical time (Nehring, 2008). Good outcomes were seen in all groups suggesting that instructors can feel good about student learning even when scheduling may require that entire clinical groups must participate in a given simulation. Therefore, choices regarding simulation group size should be based on learning objectives, student experience, and faculty resources.

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